OCEAN DUMPING IN THE UNITED STATES-1976

Fourth Annual Report of the Environmental Protection Agency

on Administration of Title I

Marine Protection, Research, and Sanctuaries

Act of 1972, as amended

U.S. ENVIRONMENTAL PROTECTION AGENCY
Washington, D.C. 20460

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JUNE 1976

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Water and Hazardous Materials
Washington, D. C. 20460

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I. INTRODUCTION AND SUMMARY

This is the fourth annual report of the Environmental Protection Agency (EPA) to the Congress on the implementation of Title I of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended, (referred to in this report as "the Act"). The Act became effective April 23, 1973, and since that time all ocean dumping of waste materials transported for the purpose of dumping has been done under permit from EPA except for dredged material, which is regulated by the Corps of Engineers (COE).

When the program was first initiated many procedural and technical decisions had to be made on an interim basis because of the need to implement the Act rapidly and the general lack of specific knowledge of the impact of ocean dumping on the marine environment. It was also apparent that the widespread practice of the ocean dumping of environmentally damaging materials, which had been going on for many years, could not be stopped instantaneously without allowing time for the development of acceptable alternatives. During the three years since the Act became effective, the interim procedures and criteria have been replaced by improved regulations and criteria; better laboratory methods of analysis have been developed; a program of baseline surveys has been initiated; and many dumpers of toxic wastes have been phased out or are on firm implementation schedules.

This annual report covers the third full year of regulation of ocean dumping by EPA under Title I of the Act. This year has seen the following accomplishments:

(1) Revised regulations and criteria have been developed for proposal in 1976. The revisions are based on advances in the state of knowledge of marine pollution, operating experience, and the need to bring the criteria into full compliance with the International Ocean Dumping Convention.

(2) The International Ocean Dumping Convention has been acceded to by the required number of Nations and is now in force. The first meeting of the signatory Nations was held in London in December 1975 to set up a permanent international organization to manage international ocean dumping activities.

(3) Baseline surveys on an alternate sludge dumping site in the New York Bight were completed along with additional studies in other parts of the Bight. A Draft Environmental Impact Statement (EIS) is being prepared and will be out for public review in 1976. Monthly monitoring surveys are conducted at the existing New York sewage sludge site.

(4) A final EIS on the Gulf incineration site has been prepared, and the site is being formally designated for the ocean incineration of organochlorine wastes on a continuing basis.

(5) A monitoring protocol for monitoring ocean incineration operations is being developed and will be published in a technical report.

(6) Detailed procedures for bioassays for ocean dumping permit applications will be published shortly.

(7) Municipalities in the New York-New Jersey Metropolitan Area, Philadelphia and Camden have been advised that they must stop ocean dumping of sewage sludge by 1981.

(8) Monitoring surveys of the Philadelphia and DuPont dumpsites have continued on a quarterly basis, and preparation of an EIS will begin in 1976.

(9) Excluding dredged material, ocean dumping activity shows a net decrease of about 14 percent from 1974 to 1975. This is the result of the phasing out of industrial dumpers as the result of implementation of alternatives developed during the past few years.

(10) The Coast Guard reported eight violations of the Act to EPA. All were investigated, and letters of warning or other action was taken. In six cases civil penalties were assessed and paid; two are pending.

The major problem in the future is anticipated to be increased pressure to ocean dump waste residues which result from more and better waste treatment facilities removing increased amounts of environmentally hazardous constituents from both municipal and industrial waste streams. The basic EPA approach has been to attempt to find and use the least environmentally damaging site and method of disposal for each waste whether it involves land,

air, or water. Much additional study is needed on all disposal methods, including land disposal and incineration, as well as ocean dumping, before the state-of-the-art will be sufficient to allow the selection of the best environmental alternative in all cases.

II. PERMIT OPERATIONS

It is the policy of the Act to regulate all ocean dumping and to prevent or strictly limit the ocean dumping of any material which would adversely affect the marine environment. To implement this policy, Title I of the Act establishes a system of permits to be administered by EPA and COE to control dumping in ocean waters. The transportation from the United States of any radiological, chemical, or biological warfare agent, or high-level radioactive wastes for dumping in ocean waters, the territorial sea or the contiguous zone is prohibited. Transportation for the purpose of dumping of other materials, except dredged material, is prohibited unless the Administrator of EPA has issued a permit. The Administrator is empowered to issue a permit after a determination by him that the dumping will not unreasonably degrade or endanger human health or the marine environment. The dumping of dredged material is regulated by COE in accordance with EPA and COE developed criteria.

Title I also requires the Administrator to promulgate criteria for reviewing and evaluating permit applications, which must include an examination of the need for the proposed dumping and the alternatives available to the proposed dumping. The Administrator is also authorized to designate areas where ocean dumping may be permitted and to designate critical areas

where dumping is prohibited. EPA must also give notice and allow opportunity for public hearing before any permit is issued.

EPA has the authority to assess civil penalties for violation of permit conditions. There is also a provision for criminal action against persons who knowingly violate the Act.

Title II of the Act requires the National Oceanic and Atmospheric Administration (NOAA) to conduct a comprehensive program of research and monitoring regarding the effects of the dumping of material into ocean waters. Title III gives to NOAA the authority to establish marine sanctuaries.

Table I lists by Regions those permits in force during 1975, the type of permit, the material dumped, the date the most current 1975 permit expires, and the actual amount of waste dumped under the permit.

Under Title I of the Act, the Coast Guard has been delegated the responsibility to conduct surveillance and other appropriate enforcement activity to prevent unlawful ocean dumping. More specifically, they ensure that ocean dumping is conducted under an effective permit, that the material is dumped at the location and in the manner specified within the permit, and that the material meets the criteria outlined in the permit.

The Coast Guard's enforcement program objective is close surveillance of the transportation and dumping of materials dumped at EPA's toxic waste sites and spot checks of all other

TABLE 1
PERMIT ACTIVITY - CALENDAR YEAR 1975

Permittee/Type Permit	Material Dumped	Expiration Date of Current Permit	Actual Quant. Dumped
Region I			
Safety Projects & Eng. special	misc. lab reagents	6/30/76	114 drums
Region II			
Bergen Co. Sew. Auth. interim	sewage sludge	6/30/76	20,000 wet T.
Joint Meeting of Essex & Union Counties interim	"	"	116,000 wet T.
Linden Roselle Sew. Auth. interim	"	"	142,000 wet T.
Middlesex Co. Sew. Auth. interim	"	"	331,000 wet T.
Middletown Sew. Auth. interim	"	"	20,000 wet T.
Passaic Valley Sew. Auth. interim	"	"	570,000 wet T.
City of Glen Cove interim	"	"	4,000 wet T.
City of Long Beach interim	"	"	7,000 wet T.
County of Nassau interim	"	"	349,000 wet T.
County of Westchester interim	"	"	112,000 wet T.
West Long Beach Sew. Dist. interim	"	"	600 wet T.
New York City interim	"	"	2,040,000 wet T.

TABLE 1 (CONT'D)
PERMIT ACTIVITY - CALENDAR YEAR 1975

Permittee/Type Permit	Material Dumped	Expiration Date of Current Permit	Actual Quant. Dumped
Modern-PCI Corp. interim	Sewage Sludge	6/30/76	212,000 wet T.
General Marine Transport Corp. interim	"	"	88,000 wet T.
Modern Transp. Co. interim	digester cleanout & chemical wastes	11/19/76	67,000 wet T.
American Cyanamid interim	chemical wastes	"	128,000 wet T.
Allied Chemical interim	by-product hydrochloric acid	"	53,000 wet T.
DuPont-Grasselli interim	chemical wastes	"	290,000 wet T.
PCI International interim	chemical wastes	10/31/76	252,000 wet T.
Chevron Oil Co. interim	refinery wastes	10/31/75	24,000 wet T.
NL Industries interim	spent sulfate sol.; inert ore slurry	11/19/76	2,030,000 wet T.
Moran Towing Corp. special	construction rubble	11/19/78	185,000 c.y.
Crompton & Knowles interim	chemical wastes	2/16/76	19,000 wet T.
Region III			
City of Camden interim	sewage sludge	11/11/76	13,000,000 gal.
DuPont - Edge Moor interim	titanium dioxide wastes	11/13/76	90,000,000 gal.
City of Philadelphia interim	sewage sludge	2/13/76	170,000,000 gal.

TABLE 1 (CONT'D)
PERMIT ACTIVITY - CALENDAR YEAR 1975

Permittee/Type Permit	Material Dumped	Expiration Date of Current Permit	Actual Quant. Dumped
Region VI			
Shell Chemical Co. interim	spent caustic & digested biol. sludge	2/20/76	100,000 T.
Ethyl Corp. interim	sodium-calcium sludge	3/12/76	1,700 T.
DuPont - Beaumont interim	chemical mfg. wastes	2/13/75	18,000 T.
Region IX			
U.S. Army Corps of Engineers emergency	MV Caribia	12/26/75	permit not used
Headquarters			
Shell Chemical Co. interim	organo-chlorine wastes	1/20/75	4,200 metric tons
Foss Launch & Tug Co. emergency	barge	10/13/75	2,500 T.

disposal activities. Surveillance methods operationally available include the escort or interception of dumping vessels by Coast Guard vessels or aircraft, the comparing of dumpers' logs with permits and Coast Guard notification and sighting logs, and the use of shipriders to ascertain position and dumping rate.

The Ocean Dumping Surveillance and Enforcement program has prompted the development of an electronic Ocean Dumping Surveillance System (ODSS) which will eliminate the requirement for shipriders on all vessels carrying such a "black box." Vessels engaged in one-time or very infrequent dumping will not be required to install the ODSS, and vessels operating in areas covered by radar or other continuous surveillance may also be exempted from this requirement.

Two prototype systems of the ODSS were installed last summer on two dumping vessels operating out of New York. The systems consist of an automatic LORAN-C receiver, a clock, and a recorder which records time versus position. The recorder tape can be "read" by computers at Coast Guard district offices and, when desired, the computer can provide a graphic display of the vessel's voyage. Through these data, it can be ascertained that the dumper traveled to the proper site and remained for a period of time consistent with his volume and required discharge rate. A dump valve or dump door sensor may be added to the next generation prototype or first operational

system so that the actuation of the dumping mechanism will also be recorded. The LORAN-C receivers continuously display two LORAN-C time delay signals in digital form so that the vessel's navigator has only to apply these readings to his LORAN-C chart to obtain a rapid and accurate two-line fix.

If and when the ODSS is adopted, the ability of the Coast Guard to conduct surveillance at night will be greatly enhanced, as they presently are limited primarily to search and rescue-related resources for night surveillance. The system will similarly enhance effectiveness during other periods of reduced visibility when, as at night, unlawful dumping is most likely to occur. However, the "black box" surveillance method is viewed as only supplemental to present means of surveillance. First, it is not "real time" surveillance. The recorded data must be retrieved and analyzed after the dumper has completed his mission and returned to port. The second, and related, factor is the question of the acceptability and sufficiency of the system's tapes as sole evidence. At worst, however, this source of information should alert the Coast Guard to the few dumpers who may warrant closer attention, thereby permitting the most effective utilization of their operational resources. Obviously, too, it should provide a significant degree of deterrence to intentional violations.

Under Title II authority, the Coast Guard continues to cooperate with EPA and NOAA in their research on the effects

of ocean dumping and other man-induced changes to ocean ecosystems. Interagency agreements provide for Coast Guard support in these joint activities. Under Title III, providing for designation of marine sanctuaries, the Coast Guard is working with NOAA toward effective enforcement of present and proposed sanctuary regulations.

In 1975 the Coast Guard conducted 591 disposal surveillance missions and 70 vessel boardings. Eight violations were detected and reported to EPA. Two of these violations were dumping off site; one was dumping without a permit; and the remaining five were failure to notify of change in plans, dispersal rate exceeded, falsified report of duration of dumping, failure to obtain and submit fathometer records in accordance with permit conditions, and dumping prior to daylight conditions. In all of these cases EPA has issued notices of violation. Penalties have been assessed and paid in all but two of these cases, and these two are pending.

In addition to violations reported by the Coast Guard, EPA has issued notices of violation in six other cases in which either penalties have been assessed or final determinations are pending.

III. ANALYSIS OF EXISTING DUMPING ACTIVITY

During the three years that the Act has been in effect all previously unregulated dumping of wastes into ocean waters has come under strict regulation by the Ocean Dumping Permit Program. The level of dumping activity that has occurred under EPA permits since the program became operational is indicated in Table 2.

The absence of complete and accurate dumping records prior to the implementation of the permit program makes any comparison with ocean dumping activity of past years difficult. It is evident, however, that ocean dumping of wastes was increasing when the Act was passed. In addition, both the Senate and House versions of this Bill reflected the concern that those pollutants, which were previously discharged into the Nation's territorial waters or air and are now restricted by the Federal Water Pollution Control Act Amendments of 1972 and the Clean Air Act, not end up indiscriminately being dumped in the ocean.

The data in Table 2 show a decrease from 1973 to 1975 in the dumping of industrial wastes, construction debris, and solid waste, a slight increase in the dumping of sewage sludge, and no dumping of explosives. The permit program went into effect in mid - 1973, so the data from that year reflect eight months of dumping activity extrapolated for 12 months to estimate an annual rate.

In implementing the ocean dumping permit program, EPA requires a thorough evaluation in all applications of the need

TABLE 2

OCEAN DISPOSAL: TYPES AND AMOUNTS, 1973*, 1974**, and 1975***

(IN TONS, APPROX.)

WASTE TYPE	ATLANTIC			GULF			PACIFIC			TOTAL		
	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975
Industrial Waste	3,642,800	3,642,000	3,322,300	1,408,000	950,000	123,700	0	0	0	5,050,800	4,592,000	3,446,000
Sewage Sludge	4,898,900	5,010,000	5,039,600	0	0	0	0	0	0	4,898,900	5,010,000	5,039,600
Construction & Demolition Debris	973,700	770,400	395,900	0	0	0	0	00	0	973,700	770,400	395,900
Solid Waste	0	0	0	0	0	0	240	200	0	240	200	0
Explosives	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	9,515,400	9,422,400	8,757,800	1,408,000	950,000	123,700	240	200	0	10,923,640	10,372,600	8,881,500

* 1973 Source - EPA Regional Offices. Unpublished reports, 1973; updated information, 1976 (8 months of dumping activity, May to December 1973 under permits issued by Ocean Disposal Program extrapolated for 12 months to provide an annual rate).

** 1974 Source - EPA Regional Offices. Unpublished reports, 1974; updated information, 1976 (12 months of dumping activity).

*** 1975 Source - EPA Regional Offices. Unpublished reports, 1975; updated information, 1976 (12 months of dumping activity).

for ocean dumping and the availability of alternative methods of disposal. This approach has required a number of industrial dumpers to seek other alternatives. Since the permit system has been effective, 81 former or potential ocean dumpers are not ocean dumping (Table 3). Other permittees on implementation plans to phase out ocean dumping are shown in Table 4. On the Atlantic Coast alone, 67 former dumpers ceased ocean dumping either by the time the Act went into effect or after having initially received permits. Another nine companies here have either withdrawn their applications or have been denied permits. At least 10 current dumpers are scheduled to cease ocean dumping by December 1976, and eight more by July 1977.

The amount of industrial wastes dumped in the Gulf of Mexico under ocean dumping permits declined in 1975 to less than 10 percent of the amount dumped in 1973 under the first year of the permit program. This decrease is due largely to the fact that five of the seven original permittees had implemented alternatives to ocean dumping by the end of 1975. Although a number of dumpers have ceased ocean dumping off the Atlantic Coast, the amount of dumping has only decreased slightly due to industrial growth during which time the companies have been seeking alternatives to ocean dumping.

The slight increase in the amount of sewage sludge being ocean dumped off the Atlantic Coast is due to increased plant capacity and additional levels of treatment of municipal waste, not to an

TABLE 3

OCEAN DUMPING PERMITS
NOT GRANTED OR PHASED OUT (CONT)

2

	Region	Company	Location	Date Phased Out or Denied
45.	II	General Color Co.	Newark, N.J. 07114	April 1974
46.	II	J.M. Huber Corp.	Edison, N.J. 08817	April 1974
47.	II	Lily-Tulip	Holmdel, N.J. 07733	April 1974
48.	II	The National Lockwasher Co.	North Branch, N.J. 08876	April 1974
49.	II	Howmedica, Inc.	Rutherford, N.J. 07070	April 1974
50.	II	Celanese Coatings Co.	Belvidere, N.J. 07823	April 1974
51.	II	American Cyanamid Co.	Pearl River, N.Y. 10965	April 1974
52.	II	Green Village Packing Co.	Green Village, N.J. 07960	April 1974
53.	II	The Mennen Co.	Morristown, N.J. 07960	April 1974
54.	II	Weyerhaeuser Co.	Closter, N.J. 07624	April 1974
55.	II	Wilson Products Co.	Neshanic, N.J. 08853	April 1974
56.	II	American Cyanamid Co.	Bound Brook, N.J. 08805	April 1974
57.	II	Kimberly-Clark Corp.	Spotswood, N.J. 08804	April 1974
58.	II	St. Regis Paper Co.	West Nyack, N.Y. 10994	April 1974
59.	II	Hercules, Inc.	Kenvil, N.J. 07847	April 1974
60.	II	Dow Chemical	Mt. Holly, N.J. 08060	April 1974
61.	IX	H-10 Water Taxi	San Pedro, Calif. 90733	Sept. 1974
62.	VI	E.I. duPont de Nemours	Belle, W.Va. 25015	Oct. 1974
63.	II	A&S Transport Co.	So. Kearny, N.J. 07032	Dec. 1974
64.	VI	GAF Corporation	Texas City, Texas 77590	Dec. 1974
65.	I	Pine State By-Products, Inc.	S. Portland, Maine 04106	Jan. 1975
66.	VI	E.I. du Pont de Nemours	LaPorte, Texas 77571	Jan. 1975
67.	VI	E.I. du Pont de Nemours	Beaumont, Texas 77704	Feb. 1975
68.	II	Blue Ridge-Winkler Textiles	Bangor, Penn. 18102	June 1975
69.	II	The Nestle Co., Inc.	Freehold, N.J. 07728	June 1975
70.	II	U.S. Radium Corp.	Hackettstown, N.J. 07840	June 1975
71.	II	Tenco Division of the Coca-Cola Co.	Morris Plains, N.J. 07950	June 1975
72.	II	Warner-Lambert Co.	Morris Plains, N.J. 07950	June 1975
73.	II	Mycalex Corp.	Clifton, N.J. 07011	June 1975
74.	II	Worthington Biochemical Corporation	Freehold, N.J. 07728	June 1975
75.	II	Howmet Corp.	Dover, N.J. 07801	June 1975
76.	II	Sherwin Williams Co.	Newark, N.J. 07101	June 1975
77.	II	William Schaeffer Septic	Pequannock, N.J. 07101	June 1975
78.	III	Sun Oil Company	Marcus Hook, Penn. 19061	July 1975
79.	II	Solvents Recovery Services	Linden, N.J. 07036	July 1975
80.	II	Eagle Extrusion Corp.	Dover, N.J. 07801	July 1975
81.	II	Chevron Oil Co.	Perth Amboy, N.J. 08861	Oct. 1975

TABLE 3 (CONT'D)

OCEAN DUMPING PERMITS NOT GRANTED OR PHASED OUT

	Region	Company	Location	Date Phased Out or Denied
1.	II	Benjamin Moore & Co.	Newark, N.J. 07105	before April 1973
2.	II	Chester Packing Co., Inc.	Chester, N.Y. 10918	before April 1973
3.	II	Childers Products Co.	Bristol, Penn. 19007	before April 1973
4.	II	Clairol, Inc.	Stamford, Conn. 06904	before April 1973
5.	II	Debell & Richardson	Enfield, Conn. 06802	before April 1973
6.	II	Dow Chemical Service	Stoneham, Mass. 02180	before April 1973
7.	II	Drake Bakeries	Wayne, N.J. 07470	before April 1973
8.	II	Drew Chemical	Boonton, N.J. 07005	before April 1973
9.	II	Electro-Nucleonics, Inc.	Fairfield, N.J. 07006	before April 1973
10.	II	Engelhard Industries	Newark, N.J. 07015	before April 1973
11.	II	Fedders Corp.	Edison, N.J. 08817	before April 1973
12.	II	Ford Motor Co.	Mahwah, N.J. 07430	before April 1973
13.	II	Gamlen Chemical Co.	Elmwood Park, N.J. 07407	before April 1973
14.	II	Heinzelmen & Sons	Carlstadt, N.J. 07072	before April 1973
15.	II	B. Horstmann Co.	East Hanover, N.J. 07936	before April 1973
16.	II	I.C.I. America, Inc.	Bayonne, N.J. 07002	before April 1973
17.	II	International Paper	Whippany, N.J. 07981	before April 1973
18.	II	Ivers-Lee Co.	W. Caldwell, N.J. 07008	before April 1973
19.	II	Koppers Co., Inc.	Kearny, N.J. 07032	before April 1973
20.	II	Lehn & Fink, Co.	Belle Mead, N.J. 08502	before April 1973
21.	II	L & M Trucking Corp.	Kenilworth, N.J. 07033	before April 1973
22.	II	Makar Trucking Co.	Mendham, N.J. 07945	before April 1973
23.	II	National Can Corp.	Piscataway, N.J. 08854	before April 1973
24.	II	NL Industries, Inc.	Pedricktown, N.J. 08067	before April 1973
25.	II	Norton & Sons, Inc.	Bayonne, N.J. 07002	before April 1973
26.	II	New York Twist Drill Mfg. Corp.	Ramsey, N.J. 07446	before April 1973
27.	II	The Parker Co.	Wayne, N.J. 07470	before April 1973
28.	II	G. Redner, Inc.	Wanaque, N.J. 07465	before April 1973
29.	II	Sandoz-Wander, Inc.	East Hanover, N.J. 07936	before April 1973
30.	II	Three Star Anodizing Corp.	Beacon, N.Y. 12508	before April 1973
31.	II	Universal Oil Products	East Rutherford, N.J.	before April 1973
32.	VI	E.I. duPont de Nemours	La Place, La. 70068	Nov. 1973
33.	I	Pratt & Whitney	East Hartford, Conn. 06108	1973
34.	II	Biocraft Corp.	Waldwick, N.J. 07463	1973
35.	II	Alcholac, Inc.	Ossing, N.Y. 10562	1973
36.	II	Everlon Fabrics Corp.	Closter, N.J. 07624	1973
37.	II	The Ansul Co.	Marinette, Wisc. 54143	1974
38.	II	Consolidated Edison Co.	New York, N.Y. 10003	1974
39.	II	BASF Wyandotte Corp.	So. Kearny, N.J. 07032	1974
40.	II	The Clorox Co.	Jersey City, N.J. 07305	1974
41.	II	Gaess Environmental Services Corp.	Passaic, N.J. 07055	1974
42.	II	Bell Telephone Laboratories	Whippany, N.J. 07981	1974
43.	II	Amerada Hess Corp.	Woodbridge, N.J. 07095	1974
44.	II	Riegel Products Corp.	Milford, N.J. 08848	1974

TABLE 4

PERMITTEES ON IMPLEMENTATION PLANS
TO PHASE OUT OCEAN DUMPING

Region	Company	Location	Phase Out Date
II	American Cyanamid Co.	Linden, NJ	1979
	Middletown Sewer Authority	Belford, NJ	1981
	Passaic Valley Sew. Comm.	Newark, NJ	1981
	Allied Chemical Corp.	Morristown, NJ	1981
	The Upjohn Manuf. Co.	Barceloneta, PR	1978
	E.I. duPont de Nemours	Linden, NJ	1981
	City of Long Beach	Long Beach NY	1981
	Middlesex Co. Sew. Auth.	Sayreville, NJ	1981
	New York City	New York, NY	1981
	Merck & Co., Inc.	Rahway, NJ	1981
	Abbott Chemicals, Inc.	Barceloneta, PR	1978
	NL Industries, Inc.	So. Amboy, NJ	1981
	Modern Transportation Co.	So. Kearny, NJ	1981
	Bergen Co. Sew. Authority	Little Ferry, NJ	1981
	Linden Roselle Sew. Auth.	Linden, NJ	1981
	Elizabeth Joint Meeting	Irvington, NJ	1981
	Pfizer Pharmaceuticals, Inc.	Barceloneta, PR	1978
	Merck Sharp & Dohme	Barceloneta, PR	1978
	County of Nassau	Mineola, NY	1981
	County of Westchester	White Plains, NY	1981
	West Long Beach Sew. Dist.	Atlantic Beach, NY	1981
	Oxochem Enterprises	Ponce, PR	1978
	Puerto Rico Olefins Co.	Ponce, PR	1978
	Whippany Paper Board Co.	Whippany, NJ	1977
	Sobin Chemicals Co.	Newark, NJ	1977
	International Wire Products	Wyekoff, NJ	1977
	City of Glenn Cove	Glen Cove, NY	1981
	Arrow Group Industries	Haskell, NJ	1976
	Reheis Chemical Company	Berkeley Hts., NJ	1977
	Bristol Alpha Corporation	Barceloneta, PR	1978
	M/M Mars	Hackettstown, NJ	1977
	The Coca-Cola Company	Hightstown, NJ	1976
	Curtiss-Wright Corp.	Fairfield, NJ	1976
	Norda, Inc.	East Hanover, NJ	1976
	S.B. Penick & Co.	Montville, NJ	1977
	Pfizer, Inc.	Parsippany, NJ	1977
	J.T. Baker Chemical Co.	Phillipsburg, NJ	1977
	Fritzsche Dodge & Olcott	Clifton, NJ	1976
	Keuffel & Esser	Morristown, NJ	1977
	Caldwell Trucking Co., Inc.	Fairfield, NJ	1981
	Schering Corp.	Manati, PR	1978
	American Cyanamid Co.	Wayne, NJ	1976
	S.B. Thomas, Inc.	Totawa, NJ	1976
	General Marine	Bayonne, NJ	1981
	Crompton Knowles	Reading, PA	1981
III	City of Camden	Camden, NJ	1981
	City of Philadelphia	Philadelphia, PA	1981
	E.I. duPont de Nemours	Edge Moor, DE	1978

increased number of municipal dumpers. About four million tons of unwatered municipal sludge were dumped in the New York Bight in 1975. Upgrading present treatment facilities to secondary level with 90% reduction of biochemical oxygen demand (BOD) and suspended solids, plus treatment of the present raw sewage discharges, will significantly increase the volume of sludge to be handled. Unless environmentally acceptable alternative sludge disposal methods are developed, this additional sludge will be dumped in the ocean.

The decrease in construction rubble is due primarily to the cessation of the work on the Harlem River Water Supply Tunnel. The construction debris from this project was being transported to the ocean and dumped.

As indicated in Table 2 ocean dumping of barged wastes is currently utilized as a disposal technique predominately on the East and Gulf Coasts for industrial wastes and on the East Coast alone for sewage sludge. This is not merely because these areas have failed to fully pursue alternatives to ocean disposal, but rather a combined result of historical usage of ocean dumping and immediate unavailability of alternate methods of disposal.

The use of ocean outfall pipes and the availability of land for disposal on the West Coast have made unnecessary the barging of wastes to the ocean. Inland disposal of municipal effluents and sludges in the Gulf Coast states has prevented the development of ocean dumping of municipal wastes into the Gulf of Mexico.

On the other hand, it has been those areas open to the sea with a high density of population and industrial development such as Metropolitan New York and Philadelphia that have turned to ocean dumping. Now these industrial and municipal dumpers are being required to evaluate the alternatives to ocean dumping to determine what is the most environmentally acceptable method of disposal.

In 1975 11 ocean disposal sites were in active use (Figure I). The types of wastes being dumped at each site is indicated in Table 5, as well as the projected phase out dates for dumpers at each site.

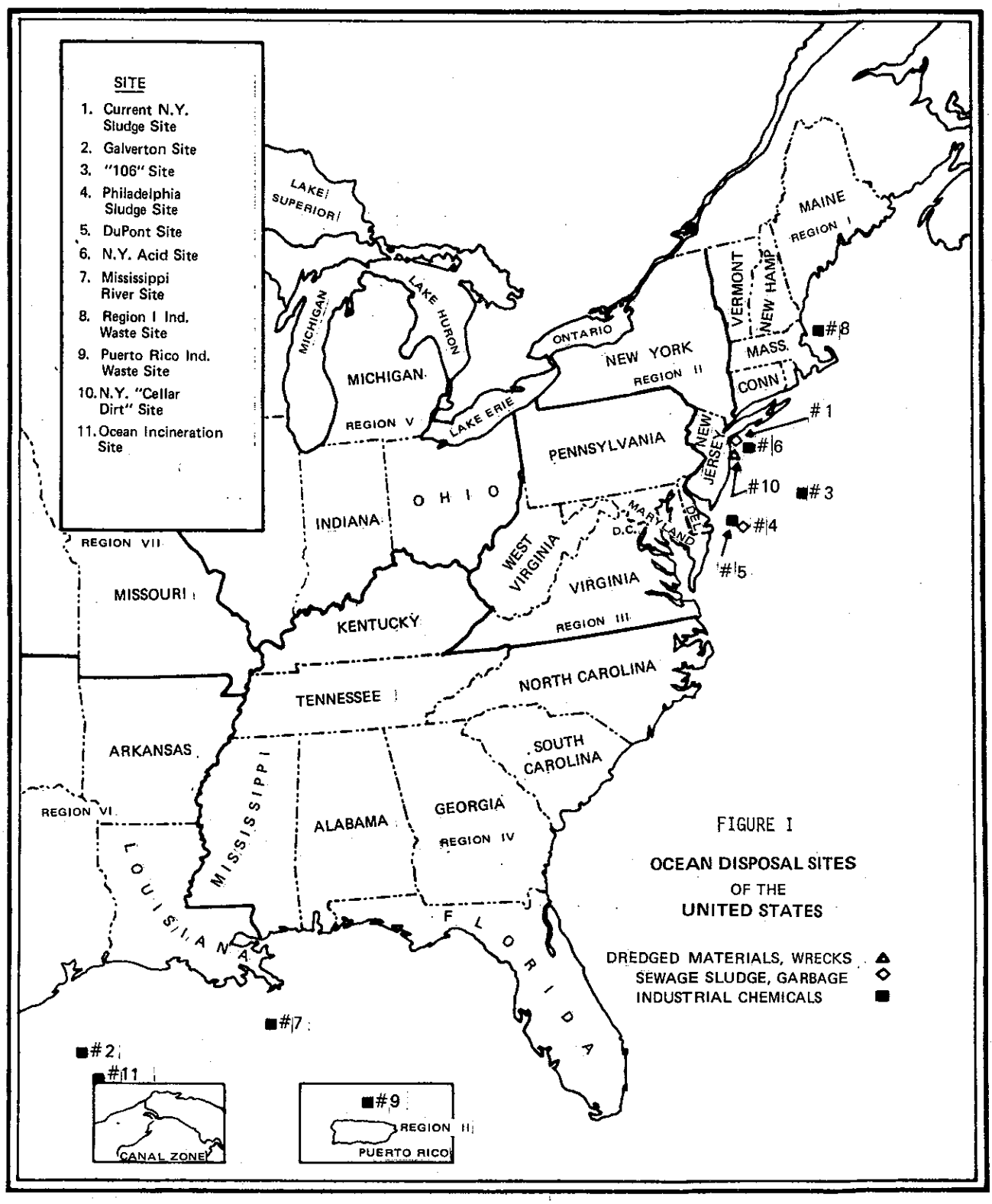
SITE
1. Current N.Y. Sludge Site
2. Galverton Site
3. "106" Site
4. Philadelphia Sludge Site
5. DuPont Site
6. N.Y. Acid Site
7. Mississippi River Site
8. Region I Ind. Waste Site
9. Puerto Rico Ind. Waste Site
10. N.Y. "Cellar Dirt" Site
11. Ocean Incineration Site
LAKE SUPERIOR
MICHIGAN
LAKE HURON
MICHIGAN
REGION V
LAKE ERIE
ONTARIO
NEW YORK
REGION II
MAINE
REGION I
VERMONT
NEW HAMP.
MASS.
CONN.
#8
#1
#6
#10
#3
#4
#5
PENNSYLVANIA
NEW JERSEY
MARYLAND
DEL.
D.C.
WEST VIRGINIA
VIRGINIA
REGION III
INDIANA
OHIO
REGION VII
MISSOURI
KENTUCKY
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
ARKANSAS
REGION VI
MISSISSIPPI
ALABAMA
GEORGIA
REGION IV
LOUISIANA
FLORIDA
#7
#2
#11
CANAL ZONE
#9
REGION II
PUERTO RICO
FIGURE I
OCEAN DISPOSAL SITES
OF THE
UNITED STATES
DREDGED MATERIALS, WRECKS
SEWAGE SLUDGE, GARBAGE
INDUSTRIAL CHEMICALS

TABLE 5

DISPOSAL SITES FOR OCEAN DUMPING

Dump Sites For Municipal And Industrial Wastes

	Site		Center Points	Nature of Use	Phase Out Date for Dumpers
1.	Current N.Y. Sludge Site	Lat. Long.	40° 22' 30"N 73° 41' 30"W	municipal sewage sludge	1981
2.	Galveston Site	Lat. Long.	27° 20'N 94° 36'W	industrial wastes	Dumpers under strict implementation plan to develop alternatives to O. D.
3.	"106" Site	Lat. Long.	38° 50'N 72° 15'W	industrial wastes	1981 (all but 4 dumpers out by Dec. 1977)
4.	Philadelphia Sludge Site	Lat. Long.	38° 21'N 74° 10'W	municipal sewage sludge	January 1981
5.	DuPont Site	Lat. Long.	38° 30'N 74° 15'W	acid wastes	November 1978
6.	N.Y. Acid Site	Lat. Long.	40° 18'N 73° 38'W	acid wastes	1981 or bring waste within limitations of criteria
7.	Mississippi River Site	Lat. Long.	28° 05'N 89° 22.5'W	industrial wastes	dumper under strict implementation plan to develop alternatives to O. D.
8.	Region I Ind. Waste Site	Lat. Long.	42° 25'N 70° 35'W	industrial wastes	dumper under strict implementation plan to develop alternatives to O. D.
9.	Puerto Rico Ind. Waste Site	Lat. Long.	19° 15'N 66° 42.5'W	industrial wastes	April 1978
10.	N.Y. "Cellar Dirt" Site	Lat. Long.	42° 23'N 73° 49'W	construction or demolition debris	none
11.	Ocean Incineration Site	Lat. Long.	26° 40'N 93° 40'W	ocean incineration	none
12.	Proposed DuPont Site in S. E. Gulf of Mexico	Lat. Long.	27° 00'N 87° 00'W	industrial wastes	site never used

IV. BASELINE SURVEY PROGRAM

Section 102(c) of the Act authorizes the Administrator to designate recommended sites or times for dumping, considering the criteria of Section 102(a). When the interim regulations were published, a list of interim dump sites was included. These sites were selected from existing information on ocean dumping and were selected based on historical usage, not on environmental criteria governing the selection of sites to minimize damage to the marine environment. This was recognized as a temporary expedient, and EPA has since made the commitment that it will comply with EPA's Regulatory EIS procedures in the designation of ocean dumping sites for continuing use.

Regulations are being prepared to be proposed to establish the procedures by which ocean dumping sites will be designated for continuing use; these procedures include the preparation of an EIS for virtually all ocean dump sites presently in use or proposed for use.

The preparation of an acceptable EIS on an ocean dumping site requires the collection of a large amount of environmental data, at the site itself and in nearby areas, to form the basis for an environmental assessment of the site and to predict the impact of dumping on the site. The data collection requirements needed for an environmental assessment of a dump site have been formalized into a standard baseline survey guideline.

This baseline survey guideline was developed in consultation with NOAA and will serve as the basic plan for all baseline surveys, with appropriate modifications being made to meet special situations. The basic plan in any baseline survey is to take samples of both water and sediments to determine the levels of specific chemical parameters in and near the dump site. Of particular interest are trace metals and persistent organic compounds that might be present in wastes dumped at the site. Samples are also taken of living organisms at and near the site in the water column, at the bottom, and in the sediments. This broad scale sampling is needed to provide data on the widest possible range of ecological features at the dump site so that an accurate assessment can be made of what the impact of pollutants would be at the dump site.

Before any acceptable appraisal of conditions at a dump site is possible, the full range of seasonal or other periodic variations in conditions must be observed. The baseline survey program began during FY 1974, and additional studies have been conducted on a continuing basis since that time. A brief synopsis of each baseline survey presently being conducted follows:

1. Alternate Sewage Sludge Dump Site in the New York Bight

Sewage sludge from the New York Metropolitan Area is currently being dumped at a site approximately twelve miles from recreational beaches. While no impact on the beaches has yet been seen from sludge dumped at this site, increased

sewage treatment in the New York Metropolitan Area will result in much greater volumes of sludge to be disposed of during the next few years. Much of this sludge may have to be ocean dumped at this site as an interim measure until a permanent form of ultimate disposal is selected and implemented.

In early 1974, EPA requested NOAA to recommend areas farther out in the New York Bight for study as alternate sludge dumping sites. NOAA recommended two areas, one just north of the Hudson Canyon and the other just south of the Hudson Canyon; EPA has completed studies, by contract, of the area recommended by NOAA just north of the Hudson Canyon and about 60 miles from Ambrose Light. The first survey was conducted during September and October 1974; the second was conducted during January and February 1975; and the third survey was conducted July and August 1975.

EPA also supported studies by NOAA in other parts of the New York Bight, and used the results of these studies, as well as its own studies to prepare an EIS on ocean dumping of sewage sludge in the New York Bight.

This EIS was made available, in draft form, for public comment in February 1976. The conclusion reached in the EIS was that dumping should continue at the existing site, a comprehensive monitoring program should be maintained for the existing site, and the alternate site should be designated so that it can be used when and if the monitoring program indicates that

the existing site cannot safely accommodate any more sewage sludge.

Steps are now being taken to implement the conclusions reached in the EIS.

2. Philadelphia/Camden and DuPont Dump Sites off Delaware Bay

Prior to the beginning of the Ocean Dumping Permit Program, Philadelphia had been dumping sewage sludge at a location approximately 11 miles seaward of the mouth of Delaware Bay. In April 1973, EPA issued an interim ocean dumping permit to Philadelphia for ocean disposal of sewage sludge, but required the city to use a site about 50 nautical miles southeast of the mouth of the Delaware Bay. Philadelphia has used this designated site up to the present time. This site is quite close to the site being used by DuPont for the disposal of waste acid.

Prior to use of the present site by Philadelphia, a single baseline survey of the site was conducted, and since then surveys have been made on a quarterly basis. These surveys have been a cooperative effort among EPA, universities, industries, NOAA and the Coast Guard. About 20-24 stations are sampled on each survey, primarily for trace metals in sediments and in organisms. Direct observations were also made in August 1974 and in August 1975 using a manned submersible.

The close proximity of these two dumpsites makes it

logistically economical to study them both at the same time. The difference in composition between the two wastes makes it possible to use different constituents as tracers to describe the movement of each waste. Using this technique statistically significant differences in the geographical distribution of trace metals in sediments and in some organisms have been found. Additional studies are being conducted to quantify the nature and extent of these differences and to establish cause and effect relationships.

3. Toxic Industrial Wastes Dump Site, East of Cape Henlopen, Delaware ("106" site)

This dumpsite is located 106 nautical miles southeast of Ambrose Light (at the entrance to New York Harbor) and approximately 90 nautical miles due east of Cape Henlopen, Delaware. The area is bounded by 38°40'N to 39°00'N and 72°00'W to 72°30'W. The site is off the continental shelf at depths ranging from 1,550 meters in the northwest corner of the site to 2,750 meters in the relatively flat southeast corner. The bottom, for the most part, is characterized by a rugged topography. A major topographic feature of the region, the Hudson Canyon, is to the north, northeast, and east of the toxic waste dump site.

This site is used by over 30 different ocean dumpers in the New York - New Jersey area for the disposal of industrial chemicals.

Typical waste materials are residual sludge from galvanizing and plating operations, liquid wastes from textile manufacturing, liquid wastes from etching and photographic processes, water solutions of inorganic salts, and similar materials resulting from diverse manufacturing processes. Containerized radioactive wastes were dumped in a location just south of the present site several years ago and prior to enactment of the act.

In May 1974 NOAA began a series of baseline surveys of this dumpsite in cooperation with EPA, the Virginia Institute of Marine Science, the Woods Hole Oceanographic Institution, the Lamont-Doherty Geological Observatory of Columbia University, and the Smithsonian Institution. The cruise report has now been completed.

Additional cruises were conducted in July 1975. The July cruise made use of the manned submersible ALVIN, and data were also collected at the radioactive waste dumping area south of the dump site.

The hydrography of the dump site area is complex and the currents are seasonally variable. Any one of three water masses may be present at different times or at different levels in the water column; shelf, slope, and Gulf Stream water have all been identified. Circulation patterns are affected by mixing across frontal zones. Currents run predominantly southward along the coast, while the Gulf Stream runs generally northeastward.

The slope water may circulate in a cyclonic gyre. Surface circulation is primarily a function of season.

In addition to hydrography, studies have also been made in the water column of the occurrence and, in some cases, relative abundance of nutrients, zooplankton, ichthyoplankton, and nekton.

The ocean bottom at the dumpsite has also been investigated by means of echo-sounding, photography, trawling, and quantitative sampling in order to describe aspects of geology, geochemistry, and benthic fauna.

Investigations have been made of heavy metal and other contaminants in water, sediments, and in the tissues of larger benthic fishes and invertebrates.

4. Gulf Incineration Site

As a result of the two research burns and the two burns under an interim permit of the organochlorine wastes from the Shell Chemical Company, environmental data on the site and on the impacts of burning at the site were collected. A report on the entire program of this incineration has been published and about 2,000 copies have been distributed.

A Draft Environmental Impact Statement has been published on the site, and the formal designation of the site for ocean incineration of organochlorine wastes will be published in August.

5. Radioactive Waste Dump Site Surveys

One of the major problems facing the nuclear industry today is the management of the large volumes of low-level radioactive wastes generated as a result of nuclear reactor operations and subsequent spent fuel reprocessing. With increased competing demands for a decreasing amount of available land, there is a growing interest both here and abroad in ocean disposal as a waste management alternative. And, in fact, some European countries have been conducting ocean dumping of packaged, low-level radioactive wastes under international supervision since 1967.

A. Farallon Islands 900m Dump Site

In 1974, EPA initiated the first successful survey of a discontinued radioactive waste dump site with the investigation of the Pacific-Farallon Islands site at a depth of 900m (3000 feet) approximately forty miles west of San Francisco, California. A report of the at-sea operations has been prepared by the EPA Office of Radiation Programs and preliminary analytical results were discussed in the EPA Third Annual Report on Ocean Dumping. Since that time the radioanalyses have been completed and the level of plutonium-239, 240 contamination in surface sediments has been found to be between 2-25 times higher than the maximum expected concentration that could have resulted from weapons testing fallout alone. Plutonium-238 contamination was also found but at lower concentrations. The plutonium-238 and 239, 240 contamination

was detected in the immediate vicinity of visually sighted radioactive waste packages.

B. Farallon Islands 1700m Dump Site

During the period of August 15-22, 1975, a survey coordinated by the EPA Office of Radiation Programs was conducted at the Farallon Islands 1700m (5300 feet) radioactive waste and munitions dump site centered at 37°37'N, 123°18'W. The survey devi used was an unmanned, tethered submersible, the CURV III (Cable-controlled Underwater Recovery Vehicle) operated by the U. S. Naval Undersea Center in San Diego, California. Radioactive waste containers were located showing the standard packaging design, i.e., 55-gallon mild steel drums filled with concrete in which the waste was mixed and solidified. Photographs of the condition of the packages were taken showing most of the packages to be intact but with a few showing evidence of hydrostatic implosion. This survey investigated only a small fraction of the more than forty thousand containers estimated to have been dumped in the general vicinity of the radioactive waste dump site.

Four bottom-moored current meters were emplaced around the site and a one-month record of current speed and direction was taken. The results showed a slow northward transport of water with a mean speed of 1.3 cm/sec and a maximum speed of 16.5 cm/sec. However, more extensive measurements are required in order to determine whether there is any net long-

term directional flow and whether the flow would be capable of moving contaminated sediments.

Preliminary results of the radioanalysis of sediment samples collected from this site indicate the presence of plutonium-238, and plutonium-239, 240 contamination at levels comparable to those found at the 900m (3000 feet) site in 1974. The levels of plutonium contamination detected so far should not be considered as a risk to man or to the marine environment. However, two significant problems remain to be resolved: (1) the extent of contamination in and around the dump site areas, for example between the 900m and 1700m sites, and (2) the presence of currents or water mass movement capable of transporting the sediments to which the radioactive materials are attached.

C. Atlantic 2800m Dump Site

One of the major Atlantic discontinued radioactive waste dump sites was surveyed using the manned submersible ALVIN during the period of July 23 - August 4, 1975. The site is centered at 38°30'N, 72°06'W at the depth of 2800m (9300 feet) and is approximately 120 miles east of the Maryland-Delaware coast and ten miles southeast of an actively-used industrial waste dump site (the "106-mile site"). It was used intermittently from 1951-1962 and received an estimated fourteen thousand drums of low-level radioactive waste containing over forty thousand curies at the time of packaging.

Eighty-gallon drums containing low-level radioactive wastes imbedded in concrete were located in the dump site area. Cesium-137 contamination was detected in the immediate vicinity of both intact and breached containers at concentrations ranging from 3-70 times higher than the maximum expected fallout concentration. Records of the packages and their radioactive contents indicate that the material may be leaching out of the concrete matrix rather than simply leaking from a breached container.

Of additional interest is the potential for transport of this released radioactive material, cesium-137, and the possibility of uptake into food chains leading to man. Preliminary experiments using a dye-string current meter array on the manipulating arm of the ALVIN submersible indicated the presence of a measurable directional bottom current. This was corroborated by evidence of sediment scouring and buildup around the radioactive waste packages. Plans are being formulated by the Office of Radiation Programs to implant deepsea current meters around the dump site to measure the velocity and direction of this current and to determine its relationship to the Western Boundary Undercurrent.

Trawls were conducted around the perimeter of the radioactive waste dump site in May 1974. The predominant fish caught in the 1974 trawls and seen in the July 1975, ALVIN submersible descents was the rat-tail fish (Nematonurus

(Coryphaenoides) armatus. However, neither this fish nor any other fish or invertebrate seen in the dump site is commercially exploited and, therefore, direct food chain transfer within the site appears unlikely. Nevertheless, the red crab Geryon quinquedens is found approximately 150 miles north of the dump site and may be exploited in the future, and commercial fish inhabit the upper layers of the water column over the dump site; thus, the potential for food chain transfer of radioactive materials translocated from the dump site is still of concern.

Although EPA does not believe that the radioactive contamination detected in this dump site presents any hazard to man or to the marine environment, it raises many questions regarding the ultimate fate of these released radionuclides, questions which should be addressed before any future permits for ocean disposal of packaged, solidified, radioactive wastes are considered.

V. EPA RESEARCH PROGRAM

The division between permit operations, baseline surveys, and fate and effects research within the overall EPA approach toward implementation of the ocean dumping permit program is not sharp. All three programs are interrelated: research information is incorporated into permit decision. In turn, permit operations provide the research program essential information on how to structure effective research; the baseline surveys provide data feedback to the permit operations program regarding the environmental effects of past permit decisions while the surveys themselves incorporate field program design and data interpretation based on research results.

Research efforts within EPA related to the ocean dumping permit program have focused on three areas since the passage of the Ocean Dumping Act in 1972. These areas are: (1) ocean dumping permit criteria development, (2) bioassay methods development, and (3) the development of techniques for environmental impact assessment. The development and improvement of criteria and bioassay methodology have been given the highest priority. As these efforts have brought positive results, additional resources have been devoted to research directed toward the assessment of environmental impact.

The environmental impact of ocean dumping is being studied directly by in-house EPA activities, as well as through grants and contracts. These efforts are being concentrated in three

general areas: trace metal impacts, impacts of persistent organic compounds such as chlorinated hydrocarbons, and modeling techniques to predict impacts. In addition, technical assistance for permit operations is provided by the EPA Office of Research and Development.

In addition to site-specific investigations, a large portion of the Federal effort is directed to investigating fate and effects of municipal wastes. The following studies highlight research on the fate and effect of sewage sludge relative to ocean dumping, or research that can be directly applied to ocean dumping situations:

- Research by the Southern California Coastal Water Research Project has studied the input of DDT and PCBs into Southern California marine waters. The work, to date, indicates that municipal wastewater discharges in Southern California and atmospheric fallout are the prevalent sources of DDT and PCBs. Available data indicate that surface runoff, industrial waste inputs, and antifouling paints are less significant sources. Other persistent organics under study include HCB and di- and trichlorobenzene. Additionally, investigators at the Southern California Coastal Water Research Project are studying the effects of ocean outfalls on the structure of benthic infauna and fish communities, the incidence of diseases, including fin rot and tumors in flat fish, and historical trends in the diversity and stability of marine ecosystems in the Southern California Bight. They also have

examined the recovery of benthic infaunal assemblages following the cessation of an outfall discharge. More work in this area is planned to focus on epifaunal rocky bottom assemblages.

- o The University of Rhode Island (URI) is emphasizing the biological effects of wastes at both ecosystem and species levels. Microcosm models of lower Narragansett Bay follow natural flushing rate, temperature, salinity, and light regimes while being subjected to stresses that mimic natural mortality and sewage disposal. Thus far the model system has been satisfactorily tested for reproducible results and field verification is underway. Another URI researcher is concentrating on the uptake of trace metals by benthic species from clean and polluted pore waters within benthic sediments. The concept of these experiments is to determine the extent to which benthic species act to cleanse sediments of entrapped heavy metals by translocating the metals into overlying waters or into the marine food web.
- o A study at Fordham University entitled "Biological Analysis of Primary Productivity and Related Processes in New York Harbor as Reflective of Changing Water Quality" is designed to investigate those processes and factors that might contribute to massive algal blooms. This study will provide information relevant to the kinds of treatment required for

municipal waste discharges. In addition, the study will investigate whether the water quality of the New York Harbor region is being affected by materials flowing into the area from offshore sludge dumping sites.

- o Researchers at Harvard University are studying the ability of native marine microorganisms to kill human pathogens released to the marine environment through ocean outfalls. These results are being incorporated into a mathematical model of the fate of coliform bacteria in the sea.
- o A study of toxic metals in domestic and industrial sewage is in progress at Massachusetts Institute of Technology (MIT). The reactivity and fate of concentrated heavy metal wastes dissolved in acid that are dumped into seawater is a complex problem that must be understood to establish safe disposal practices. Transport of toxic metals depends upon their solubility in seawater and their mobilization in the sediment and ecosystem. The MIT approach uses computer modeling of chemical solubilities and field data from a specific study of ocean dumping to determine which chemical, physical, hydrographic, and biological factors govern the transport and translocation of toxic metals dumped at sea.
- o The impact of different thicknesses of sewage sludge on the survival of representative invertebrates has been studied to determine the assimilative capacity of the marine

benthos to sewage wastes. This research led to a preliminary design for a multispecies bioassay for materials dumped at sea.

- o Indices of population dynamics and community structure, including measures of species composition, diversity, richness, dominance, density, and biotic homogeneity, are being reviewed to determine those most suitable as indicators of the effects of ocean dumping.
- o Sampling methods for the benthos, plankton, and fish communities at ocean disposal sites are being developed to provide a basis for statistically valid analyses of the health of marine ecosystems.
- o Models are being developed to simulate trophic levels, concentrations of sewage sludge, and mortality, growth, reproductive success, and bioaccumulation of trace metals. Through an interagency agreement between EPA and ERDA, the Puerto Rico Nuclear Center's research reactor is used for neutron activation analysis of heavy metals from sludge as they are incorporated into biological systems. To evaluate metal uptake and concentration where it occurs, mixed plankton, benthic infauna, and epibenthic marine organisms are analyzed following exposure to metal-laden sludge.
- o A survey of the dynamics of benthic communities and pollutant levels in a clean area of the New York Bight

is in the third year of a long-term study, which will provide a baseline against which changes in biotic conditions at disposal sites in the Bight can be assessed.

- o A biomonitoring system using the caged animal concept has been developed. The primary purpose is to show the feasibility of such a system in determining zones with high pollutant bioavailability around submerged discharges of waste. The concept uses a taut line buoy system, from which nylon mesh bags are supported at selected depths, and a metal cage rests directly on the bottom. The organism selected was a mussel, a species which readily concentrates chlorinated hydrocarbons and rapidly responds to environmental levels of such pollutants.

  Field results indicate a direct relation between uptake of DDT and PCBs and proximity of bioindicators to contaminated sediments or wastewater plumes. Plans are to use this monitoring system near three major submarine outfalls, including a sludge discharge line that has significantly high concentrations of PCBs and DDT. This planned effort should shed some light on the degree to which sediments are contaminated by sewage effluent and sewage sludge discharge, and make it possible to assess whether selected sediments are a major source of chlorinated hydrocarbons in the biota.

In addition to studies at specific sites, EPA is performing or sponsoring a number of fate and effects research projects on industrial wastes. The projects are largely aimed at perfecting appropriate bioassay techniques and methods of predicting impacts.

Bioassays to establish potential toxicity of a given waste to be dumped at sea to species indigenous to the dump site have been under development. EPA's Region II has employed assays on a zooplanktonic copepod, a phytoplanktonic diatom, and a fish to determine the manner of dumping to be employed by an applicant as an ocean dumping permit condition. Although it is recognized that bioassays employing representative indigenous species do not guarantee the integrity of an ecosystem, it is often the only available index of environmental safety. Applied conservatively to permit conditions, bioassay results plus a judgmental safety margin in rate of waste disposal may be the best available information on which to regulate ocean dumping. As part of the research effort, a manual of standard bioassay techniques has been compiled and revised as the state of knowledge has advanced.

Man's effects on the marine environment are being investigated by sediment core analysis. The history of pollutants, other than heavy metals, including petroleum, PCBs and DDT, plutonium isotopes, and man-mobilized minerals, is studied through a grant to the University of California. The historical

changes in these materials, in sediment cores, are being used to predict future environmental levels, given past and present usage patterns. Variation in pollutant concentration with depth indicates that recent sediments are most polluted. Environmental management of waste disposal depends upon predictive capabilities developed by such methods.

VI DREDGED MATERIAL DISPOSAL

A. Basis for Regulation

Section 103 of the Act vests responsibility in the COE, in cooperation with the Environmental Protection Agency, for authorizing the transportation of dredged material for the purpose of dumping it in ocean waters.

The COE published Final Regulations for the Dredged Material Permit Program on April 3, 1974, and subsequently republished them on July 25, 1975 as 40 CFR 209.120. Dredged material disposal by any Federal agency other than the COE is governed by this regulation. Thus, such Federal disposal activities receive the same scrutiny as any disposal activity by the private sector. The regulations require that a determination be made that any proposed disposal of dredged material will not adversely affect human health, welfare, amenities, the marine environment, ecological systems, or economic activities to an unreasonable degree. The regulation also provides, pursuant to the Act, for an independent determination of the need for ocean dumping. The determination is to be based on an evaluation of the potential effect which the denial of a permit would have on navigation, economic and industrial development, foreign and domestic commerce, and on other possible methods and locations for disposal. All COE projects involving ocean disposal are subject to extensive coordination with other Federal and local agencies, as well as the general public, before the proposed disposal can proceed. Further, COE dredging will not

commence until an environmental assessment and, if required, an impact statement has been prepared.

B. Volume of Dredged Material Ocean Dumped

Table 6 presents volumes of dredged material dumped in ocean waters during Calendar Years 1974 and 1975. The total volume dumped in 1975 indicates an approximate 12% reduction dumped during 1975. As is readily apparent, the major portion of the reduction (and, in fact, the greatest volume) occurred in the Lower Mississippi Valley Division. This Division indicated a tremendous increase in volume in Calendar Year 1974 over the previous year. This resulted from the aftermath of hurricanes the year before thereby emphasizing that dredging requirements placed upon the COE are subject to a very great extent to the effects of nature, and may vary greatly from one year to the next.

The sizable increase in dredging and disposal noted in the South Atlantic Division results from new outer channel dredging requirements of this Division. This dredging started late in 1974 and increased during 1975. It is anticipated that this volume will decrease during 1976 to some lower level of maintenance dredging.

C. Dredged Material Research

Research into fate and effects of dredged material and alternatives to ocean dumping is undertaken by several Federal agencies.

TABLE 6

DREDGED MATERIAL DUMPED IN OCEAN

	Calendar Year 1974			Calendar Year 1975		
	Corps of Engrs. (Cu. Yds.)	Permits (Cu. Yds.)	Total (Cu. Yds.)	Corps of Engrs. (Cu. Yds.)	Permits (Cu. Yds.)	Total (Cu. Yds.)
New England Division	1,340,400	921,800	2,262,200	551,000	331,500	882,500
North Atlantic Division	8,234,543	3,475,849	11,710,392	10,500,000	3,100,000	13,600,000
South Atlantic Division	2,931,748	2,979,500	5,911,248	11,360,250	355,000	11,715,250
Lower Mississippi Valley Division	54,600,000	-	54,600,000	33,508,087	12,000	33,520,087
Southwestern Division	9,743,982	-	9,743,982	8,581,253	None	8,581,253
South Pacific Division	7,162,918	1,292,500	8,455,418	2,516,000	190,480	2,706,480
North Pacific Division	5,982,280	-	5,982,280	7,473,792	135,000	7,608,792
Pacific Ocean Division				30,000	9,182,000	9,212,000
	89,995,871	8,669,649	98,665,520	74,520,382	13,305,980	87,826,362

The Federal Government's primary thrust in dredged material research is the Dredged Material Research Program (DMRP) of the U. S. Army Corps of Engineers. Less comprehensive research efforts on dredged material were supported by EPA and NOAA during 1975.

Dredged Material Research Program (COE)

The U. S. Army Corps of Engineers Dredged Material Research Program (DMRP) began in March 1973. One objective of this 5-year $30 million program was to provide definitive information on the environmental impact of dredging and disposal of dredged material. A second objective of the research was to develop technically satisfactory, environmentally compatible, and economically feasible alternatives for dredging and disposal. The program is being conducted by the Corps' Waterways Experiment Station (WES) at Vicksburg, Mississippi. The scope of DMRP includes upland, freshwater, and marine environs. Over 30 percent of the effort deals directly with ocean-related dredged material research.

DMRP comprises four projects, each directed by a full-time project manager and each with its own support staff. The four projects are: (1) Environmental Impacts and Criteria Development Project, (2) Habitat Development Project, (3) Disposal Operations Project, and (4) Productive Uses Project. The research effort in the Environmental Impacts and Criteria Development Project is devoted to studying the environmental impacts of both contained land and open-water disposal. In addition, this research is developing valuable regulatory criteria.

In August 1975 the former Aquatic Disposal Research Project was retitled the Environmental Impacts and Criteria Development Project. This redesignation reflects the generally increased emphasis on multiple aspects of the development of criteria and guidelines for regulating disposal operations in terms of both water quality and biological effects. Promulgation of regulatory criteria for dredged and fill material under the Federal Water Pollution Control Act (FWPCA) has been the impetus for the development of detailed evaluative procedures and interpretive guidelines for Section 404(b) of that Act. Also revision and promulgation of criteria for the Ocean Dumping Act has emphasized the need that expanded criteria research be incorporated into the project. Laboratory investigations of the acute and chronic water quality impacts of open-water disposal have been completed and have clearly delineated the problem areas from the nonproblem areas. Biological research in the laboratory is nearing completion and will provide much needed information to enable the environmental manager to minimize or negate any biological impact associated with aquatic disposal. Characterization of the pollution potential of upland containment areas has been initiated with completion of 6 to 10 selected sites. This project is now the focal point for research on the effects of both land and open-water disposal.

There are three locations for major field investigations to study the physical, biological, and chemical impacts of open-water disposal, all of which relate to ocean dumping. They are in the Pacific Ocean just off the mouth of the Columbia River; the Gulf of Mexico off Galveston, Texas; and the newly initiated estuarine site in Elliott Bay (Puget Sound) for disposal of material from the Duwamish Waterway near Seattle, Washington. The Duwamish Waterway site was selected to replace the cancelled investigation at Eatons Neck, New York, where field activities were terminated because of local public opposition.

To date, baseline research and controlled disposal investigations are completed and postdisposal monitoring is currently underway at the first two sites.

Columbia River Site - At the ocean disposal site off the Columbia River, baseline and postdisposal physical and chemical field studies have been completed. Sediment physical characteristics are being used to define the spatial distribution and volume of dredged material placed at the site; and hydrodynamic parameters, turbidity, and meteorological data will be integrated with sediment data to describe movements and temporal changes in the dredged material volume and properties. Baseline, disposal operation, and postdisposal chemical and biological data are being interpreted to ascertain overall impacts. Benthic studies have concentrated on the rate and extent of recolonization of the dredged material deposit; physical and chemical data on sediments

will be used to explain recolonization patterns. Impacts on plankton and fisheries are also being evaluated.

Galveston Site - Disposal of noncontaminated silty sand and silty clay dredged material from the Galveston entrance channel and contaminated dredged material from the Texas City Ship Channel has been completed and postdisposal research efforts are in progress. Tentative results indicate that manganese and ammonia were the only two constituents released in measurable concentrations to the water column during disposal.

Heavy metals and nutrients were either found to show no significant release or concentrations decreased during disposal operations. Chlorinated hydrocarbon studies are inconclusive at this point; however, initial field results suggest little or no release from the contaminated sediments. Initial postdisposal data indicate no apparent chronic impact on water quality at experimental disposal sites. Biological studies of the acute impact of dredged material disposal on planktonic, benthic, and demersal assemblages are complete. Longer term studies of the rates and patterns of benthic assemblage recolonization of the experimental dredged material deposits are continuing.

Elliot Bay Site - The latest addition to the aquatic disposal field investigations is the disposal site in Puget Sound. Routine channel maintenance dredged material selected for this site originates from the Duwamish Waterway. The pilot survey and

selection of the disposal site and selection of a sampling station for organisms, sediments, and water have been completed. This study will focus on the mobility and possible uptake of polychlorinated biphenyls and selected heavy metals contained in the dredged sediment. The results will be compared with those at a confined upland disposal of the most contaminated material from the Duwamish. EPA is participating in this work with the COE through an interagency agreement.

Various stages of report preparation are underway for each study site. These evolve as DMRP technical reports which are widely distributed.

Two new work units were begun in late 1975 dealing with the movement of dredged material. The first is a field investigation entitled "Effects of Winter Storms on the Stability and Fate of Dredged Material in Subaqueous Disposal Areas." This work unit was initiated in response to recommendations of a prior work unit titled "Assessment of Factors Controlling the Long-Term Fate of Subaqueous Banks of Dredged Material." The research will investigate the effects of major winter storms on the hydraulic regime and the stability and fate of deposits of dredged material at actual and potential open-water sites in central Long Island Sound.

The second work unit is "Investigation of the Physical Characteristics of Dredged Material and the Effects of Dispersion

Behavior During Open-Water Disposal Operations." This work unit is designed to field verify an estuarine dispersion model developed under a prior work unit. The objectives are to quantitatively define the physical processes that control the dispersion and disposition of dredged material that is released from a barge, hopper dredge, or pipeline and is conveyed to and emplaced upon the bottom at selected sites, and to compare these results with the theoretical (simulated) results of the model. This work unit will have direct application to ocean dumping operations.

Another recently completed task area concentrated on the laboratory evaluations of dredged material disposal. Results of these investigations have shown that acute chemical effects on the water column at a disposal site are insignificant or completely nonexistent. Only ammonium, iron, and manganese were shown to be released to the water column in quantities significantly greater than background. None of these constituents is considered highly toxic, and all are required nutrients for organisms. Mobilization of toxic metals from the redeposited dredged material over long time intervals was insignificant or was in the direction from the water to the sediment rather than from the sediment to the water. Nutrients were released in significant quantities. Almost all of the sediments studied were found to contain at least trace quantities of PCBs, DDT, and isomers of DDT. Certain other chlorinated hydrocarbons were found depending on sediment location. Very little or no chlorinated hydrocarbons were found to be released to the water column during simulated disposal.

They remained with the solid-phase sediment material. These findings are being verified by field investigations and will be tested at other DMRP field test sites.

Another preliminary conclusion generated as a result of these short-term high-intensity laboratory investigations is that oxidation-reduction conditions, which are generally found in open-water disposal areas, actually appear to inhibit the release of most sediment contaminants rather than to enhance their release. Anaerobic sediments disposed in oxygenated water are found to be an efficient scavenger of dissolved contaminants already present in the water column. Sediment organic fractions were found to account for only a small fraction of mobile heavy metals. Copper was the only exception. Sediment interstitial water concentrations at the dredged site were found to be similar to those concentrations at the disposal site. Movement out of the redeposited material at the sediment/water interface was minimal and similar to that found in natural undisturbed sediments. In summary, laboratory findings show that the intermediate release of toxic constituents due to aquatic disposal is negligible.

Another area of concern to Corps scientists is the effects of dredging and disposal, including ocean disposal, on aquatic organisms. A specific work task was designed to examine the response of representative organisms to the previously mentioned physico-chemical conditions. Laboratory investigations were made in 1975 on the effects of resuspended dredged material (turbidity) on repre-

sentative marine, estuarine, and fresh-water organisms at concentrations up to 20 grams per liter over a 21-day exposure time. This resulted in the mortality of only a small number of the organisms being assayed from freshwater and estuarine non-contaminated and moderately contaminated sediments. Sediments from the highly contaminated Oakland Inner Harbor area had critical exposure-mortality effects on marine organisms at 5-day 20-g/l and 7/day 4-g/l exposure-concentration levels. Shrimp, clams, shiner, perch, and rainbow trout were some of the organisms studied. It must be emphasized that the turbidity concentration and duration (2-20g/l for 21 days) were much greater than dredged material disposal operations. The normal range is 5-200 mg/l for a few hours.

Vertical migration investigations, completed by the University of Delaware in 1975 for the Corps, show that representative bottom-dwelling organisms have a significant ability to migrate upward through coverings of various depths of dredged material. Those organisms most severely impacted were sand-dwelling organisms that had a clayey sediment deposited on them and mud-dwelling organisms covered with a sandy dredged material. Effects of the physico-chemical nature of sediments on organism response will continue to be evaluated. However, these initial tests indicate the desirability of choosing a disposal site characterized by a substrate similar to the material to be disposed.

In other investigations, the uptake of pesticides by benthic organisms was shown to be related to the concentrations of pesticides in interstitial waters. Organisms also take up pesticides from the solid-phase material, but to a much lesser

degree. Consequently, to predict acute effects, the leaching characteristics of dredged material should be evaluated before disposal. Studies of heavy metals availability to benthic organisms from the solid-phase portion of dredged material were initiated in 1975. Sediments from the Houston Ship Channel were chosen as the contaminated dredged material. Shrimp, clams, and polychaete worms were used as test organisms. Preliminary results indicate a general toxicity of the sediments, but little uptake of a wide selection of heavy metals.

During 1975 the Corps also specifically studied the contamination status of dredged materials. To define the contamination status of dredged material required development of chemical and biological procedures for determining the contamination properties of various types of dredged material on a regional basis. Research in this area has shown dredged material to be a complex combination of naturally occurring silicate-soil material, bound and unbound water, an organic phase, and a range of contaminant and non-contaminant elements distributed within the complex. Elemental partitioning, a procedure used to characterize a sediment, showed that the release of chemical constituents from sediments is not dependent upon the total constituents present in the sediment. Consequently, it is concluded that total or bulk sediment analysis, which measures the sum of the native and contaminant forms of a constituent, does not measure the potential effect

of dredged material on water quality. These same studies also show that chemical contaminants in sediments are unequally distributed among a number of chemically defined phases. Release of contaminants from dredged material varied from site to site and was a complex function of the chemically defined phases; however, there was a statistically significant relationship between the elutriate test and those sediment phases shown to be mobile or active.

In 1975 a second study, Development of Dredged Material Disposal Criteria, was undertaken to evaluate the factors that will influence the performance of the elutriate test. Results suggest that the elutriate test response is dependent upon the oxygen concentration during the mixing procedure and insensitive to most other experimental factors. The only constituents that were generally observed to be released in potentially significant quantities during the elutriate test evaluation were ammonia and manganese. Several constituents were found to decrease. These results were verified in the field during 1975 at actual dredging operations. The elutriate test evaluation study indicated that the observed response would vary with the source of the dredged material, which suggests that the elutriate test would be sensitive to regional variations.

Solution-phase bioassay procedures developed by EPA were modified for use with the elutriate test in 1975. Biological assessment of the elutriate demonstrated that elutriates prepared from several types of dredged material would elicit a variety of response from protozoan, bacterial, and algal cultures. These

results also suggest that the elutriate test can be used with a wide variety of sediments. To properly interpret elutriate test results or bioassay results in terms of potential environmental impacts in the water column at a disposal site, additional information is being gathered on the degree of dilution and dispersion that will occur at a disposal site.

Dredged Material Disposal Criteria Research (EPA)

EPA has a responsibility under Section 404 of the FWPCA, and the Act to provide scientific criteria for the disposal of dredged materials. To develop sufficient data on which to base the required criteria, it is essential that EPA maintain its own research. In 1975 EPA's research program on dredged material fate and effects included the following studies:

- A grant to Columbia University is in progress to study concentration and bioaccumulation of trace metals attributable to disposal of dredged material and sewage sludge in sediments and overlying waters. Scientists are sampling the Hudson estuary and adjacent coastal waters. Natural radioactive tracers and heavy metals are being used. The sediment/water interchange of these materials is being studied by chemical analysis to determine the rate and nature of pollutants released from dredged materials into estuarine and coastal waters and biota. The study is also investigating the role of bacterial communities and organic polymers in heavy metal mobilization.

- Preliminary dredged material studies off Narragansett Bay have indicated the possible distribution of materials in fine grain sediments slightly beyond the limits of the dumpsite. Clayey harbor sediments were deposited on a sand substrate; consequently, the fine grain sediments contain higher natural abundances of a wide-range of heavy metal than the sand. These findings prompted an in-depth comprehensive field study conducted in October 1975. This study focused on benthic biota, including foraminifera and edible shellfish. The objective is to carefully delineate the area of influence around this dumpsite.
- The University of Michigan had a grant to study the effects of dredging on water quality in large lake systems. The major objective was to determine the rate and mechanisms of exchange of chemical species between sediments and water during disposal of dredged material in open lake waters. The study has been completed and a report is being prepared.

Dredged Material Research (NOAA)

NOAA's Dredged Material Research is concentrated in the National Sea Grant Program and the National Marine Fisheries Service. Grants under this program include studies of:

- Marsh regeneration on dredged material--by investigators in the Departments of Biology and Soil Sciences at the University of North Carolina. Seeding and transplanting have been utilized to establish Spartina on dredged material.

Breakwater protection devices have been found to assist in stabilization of dredged material shorelines. Continuous monitoring has proved that transplantation can be used to restore disturbed areas.

- Effects of dredged material disposal on benthic animals by investigators at the Graduate School of Oceanography at the University of Rhode Island. Major objectives are to determine the status of recolonization of dredged material by benthic invertebrates, identify sources of colonizing species, and predict future development of the benthos in disturbed areas.

  It has been determined that: (1) dredged material areas still have low densities of benthic animals four years after deposition, and (2) colonization of silty dredged material has been by members of natural silty communities.

- A management plan for dredged material in Central Long Island Sound by researchers at the State University of New York.

- The effects of wave processes on the erosion of dredged material islands, a new Sea Grant project at Texas A&M. Field and model studies are being conducted to provide a predictory capability necessary for site selection.

VII. OCEAN INCINERATION: A New Technique in Ocean Disposal

Since September 1974 EPA has interpreted that ocean incineration comes under the regulatory mandates established by the Act and, therefore, requires an ocean dumping permit from EPA and involves the designation of sites. EPA believes that ocean incineration is an emerging viable technological alternative, under carefully controlled conditions, to the direct dumping of the material into the marine environment. Ocean incineration is a waste burning process whereby chemical wastes are taken aboard specially designed and equipped vessels and transported to specified locations in the ocean. The onboard incinerators are fuel fired to a predetermined temperature, the waste valves are opened, and waste is fed into the incinerator. The nature of wastes being incinerated is such that once they hit the pre-heated incinerator they ignite and continue to burn.

On October 4, 1974, a public hearing was held in response to Shell Chemical Company's application for a permit to incinerate organochlorine wastes in the Gulf of Mexico. As a result of the hearing Shell Chemical Company was granted a research permit authorizing at-sea incineration of 4,200 metric tons (one ship load) of organochlorine wastes subject to specific conditions and

monitoring activities. A second research permit was issued on November 27, 1974, and an interim permit was issued on December 11, 1974, for incineration of an additional 8,400 metric tons of waste. The incineration of Shell wastes was completed on January 7, 1975, and EPA published a final report on the results of the research burns in July 1975.

During the organochlorine waste incineration tests in the Gulf of Mexico, EPA undertook a sampling and analysis program to acquire the data necessary for evaluating the incinerator waste destruction efficiency. Although these efforts provide an assessment of the acute effects of incinerating organochlorine wastes, a better understanding of the potential long-term effects of ocean incineration is needed. Evaluation of long-term effects is dependent upon the advancement of at-sea monitoring technology which is in its early stages of development.

To enable refined analysis of the potential for long-term impacts of ocean incineration, EPA is developing a test program which will serve three purposes:

1. Evaluate a test protocol for ocean incineration based on a similar protocol developed for land incineration. If successful, the test protocol may then be used to standardize source assessment equipment and techniques for monitoring ocean incineration.
2. Conduct tests to determine if additional criteria for stack gas emissions are needed which could serve as

guidelines for limiting emissions, if appropriate.

3. Acquire additional information to determine if further assessments and evaluations of potential long-term impacts to the environment are required.

The test program being developed for the incineration process at sea is based on recent studies of land-based incineration sponsored by EPA. These studies have resulted in the development of a methodology to characterize the emissions from orgnochlorine incineration and the adequacy of new waste incineration technology. This new methodology, if successfully applied to ocean incineration, would extend the current state-of-the-art for the monitoring of incineration at sea. Each new incinerator design and each category of waste with different thermochemical properties could then be evaluated by a single standard or protocol, thus providing a uniform basis of comparison of the projected impacts to the environment.

On January 9, 1975, the U.S. Air Force applied for an ocean dumping permit for the ocean incineration of its stocks of Herbicide Orange. They have also requested EPA to assist them in exploring the feasibility of reformulation or reprocessing.

Public hearings were held on the permit application in Honolulu on April 25, 1975, and in San Francisco on April 28, 1975. At these hearings the Air Force presented extensive testimony indicating that the proposed ocean incineration would do no harm

to the marine environment or cause any effects in the air. They also indicated an intent to investigate reprocessing proposals by conducting pilot plant studies on a small amount of the Herbicide Orange to see whether the claims made by the reprocessing firms were valid. They requested a reconvening of the hearing in Washington, D.C., at a later date, after the pilot plant studies were completed. The pilot plant studies were initiated by the end of 1975, and the final report with recommendations are anticipated to be completed by mid-1976.

VIII. OCEAN DUMPING CONVENTION

The Convention on the Prevention of Marine Pollution By Dumping of Wastes and Other Matter entered into force on August 30, 1975. In accordance with the provisions of Article CIV(1) of the Convention, the first meeting of the contracting parties was held in London, England, on December 17 and 18, 1975. The main objectives of the meeting were to designate an organization to carry out the Secretariat duties, provide guidance on agenda items to be considered at the First Consultative Meeting, and to establish a tentative date for the first meeting.

Delegations representing 22 contracting parties, 50 observer states, and 13 observer organizations attended the meeting. The contracting parties adopted resolution LDC(7) Rev 1 which designated the Inter-Governmental Maritime Consultative Organization (IMCO) to be responsible for Secretariat duties in relation to the Convention. Tentative agenda items were adopted and the date for the first consultative meeting was scheduled for no later than September, 1976.

In view of the importance attached to the Ocean Dumping Convention, the State Department established a subcommittee within the Shipping Coordinating Committee to ensure coordi-

nation among government agencies and to provide for public comment on U.S. positions regarding the implementation of the Convention. The first meeting of the Advisory Committee on Ocean Dumping was held on March 25, 1976, and was chaired by the Environmental Protection Agency. The purpose of the meeting was to obtain comments on the proposed U.S. submission to IMCO on the proposed agenda for the first consultative meeting of the contracting parties which is scheduled for September 20-24, 1976, at IMCO Headquarters. A second advisory committee meeting will be held to discuss the U.S. positions on the various agenda items prior to the September meeting.

IX PUBLIC PARTICIPATION IN THE PROGRAM

Section 222.5 of the Ocean Dumping Final Regulations and Criteria provides that any person may request in writing a public hearing to consider the issuance or denial of any ocean dumping permit application following public notice of receipt of such application.

During 1975 ten public hearings were held - one by Region I, three by Region II (one each on municipal and industrial permit applications on the mainland, and one in Puerto Rico), three by Region III, two by Region VI, and one by Headquarters.

Hearing attendance averaged 45 at the Region II hearings, 50 at the Region III hearings, and 25 at the Region VI hearings. Representatives of EPA and the applicants, other Federal agencies, Federal, State, and local officials, environmental groups, academia, concerned citizens and the news media attended these hearings. Those who wished to make statements on the proposed dumping did so.

In May of 1975 an adjudicatory hearing was held at EPA Headquarters to consider the City of Philadelphia's challenge to the order issued to that City requiring it to cease ocean dumping by 1981. The States of Maryland and Virginia and several environmental groups took an active part in that proceeding. Attendance at the five-day hearing was large, and media coverage was extensive. As a result of that hearing, the Administrator

affirmed the Regional Administrator's determination to require the City of Philadelphia to phase out its ocean dumping by 1981.

Since the ocean dumping permit program began, public interest has been impressive. In letters to EPA and to Senators and Congressmen, citizens from all parts of the country have expressed concern about the oceans and the possible effects of ocean dumping. Newspaper stories on ocean dumping also bring letters of response, and those who attend public hearings often express their concern about pollution of the oceans and what is being done about it.

X. ALTERNATIVES TO OCEAN DUMPING AND THE FUTURE OF OCEAN DUMPING AS A MEANS OF DISPOSAL

In its first three years of regulatory authority over ocean dumping, EPA has taken a highly restrictive approach toward applying the criteria embodied in the Act by requiring all dumpers to actively seek alternatives to ocean dumping even when their wastes have met the published EPA criteria for issuing permits. During these two years EPA has brought all ocean dumping in the United States under full regulatory control and has required many dumpers either to stop dumping immediately or to phase out their dumping activities within the next few years.

EPA has taken this approach because of the general lack of specific knowledge about the impacts of waste materials on marine ecosystems. As the results of research now underway become available, it may be possible to become more selective in permitting the disposal of some wastes by ocean dumping if it can be demonstrated that the disposal will not cause unreasonable degradation of the marine environment.

EPA is in the process of preparing proposed revisions to the existing criteria; these proposed revisions will not change the regulatory approach used in the program, but they will provide an additional measure of environmental safety, as well as additional flexibility in the long term management of ocean dumping sites. The proposed criteria establish levels of impact which define "unreasonable degradation" on a quantitative basis based on

monitoring of each dump site. The proposed criteria will allow EPA to modify the use of each site to avoid unreasonable degradation.

By using this approach it will be possible to permit some ocean dumping of certain materials which meet the criteria without causing significant damage to the marine environment.

However, at the present time most of the wastes being dumped do not meet the criteria, and, as a consequence, the dumpers of these wastes are being required to seek other alternatives for ultimate disposal of wastes which might cause unreasonable degradation. In particular, it is the intent of EPA Regions II and III to stop the dumping of all sewage sludge in the ocean by 1981.

The Cities of Philadelphia and Camden are required to end ocean dumping of sewage sludge by or before 1981. To meet the 1981 deadline, Philadelphia has a program underway to select and implement alternatives. Land application of sludge to pasture land and strip mines is being instituted on a pilot basis and composting is being studied. In addition, the City has begun a sludge giveaway program and is expending considerable effort in exploring various sophisticated technologies such as the wet-air oxidation of sludge coupled with pyrolysis.

The construction of a regional incinerator in 1980 should solve Camden's sludge disposal problem. In the interim, land application is being examined as an alternative to ocean dumping.

All other dumping of sewage sludge is by municipalities located in EPA Region II. To meet the goal of ending dumping

by 1981, EPA Region II in conjunction with the States of New York and New Jersey, has initiated a comprehensive program for development of land based alternatives to ocean dumping for these municipalities. The first phase of the study, a technical examination of applicable alternative methods, was completed in June 1975. The report recommended that the most desirable alternative for the urban metropolitan area, not considering ocean dumping, was dewatering of the sludge with filter presses followed by pyrolysis. Current estimates indicate that the implementation of this process would cost one-half billion dollars. The report also recommended that a small-scale pilot study be started immediately to develop engineering design parameters needed prior to full-scale demonstration. EPA will fund the pilot study during this fiscal year using Federal Water Pollution Control Act funds. Phase II, which is scheduled for completion in June 1976, will develop in specific terms a recommended technical plan for sludge management on a regional basis for the New York-New Jersey Metropolitan Area. This plan will include site locations, capital and operating costs, energy recovery, and an environmental impact assessment for the processes recommended in Phase I. The third phase, also under way and scheduled for completion in July 1976, will develop the legal and institutional arrangements for authorization and administration of the operating program identified in Phases I and II. The completion of this three-phase comprehensive study will provide the frame-

work for implementation of a sound program of land-based alternatives to ocean dumping of sludge in the New York-New Jersey Metropolitan Area.

The marine environment is, however, only a part of the total environment which must be used for the ultimate disposal of wastes, and problems which affect the marine environment and solutions to these problems must be viewed in terms of their interrelation with the total environment. For example, EPA under the mandate of the Act is in the process of phasing out ocean dumping of materials which do not meet the criteria, but this creates other environmental problems. Some alternative form of disposal must be developed for each waste that is phased out of ocean dumping. Considerable research is going into the development of alternative methods of disposal which will reduce the environmental effects of the ultimate disposal of the unavoidable residue - be it solid, liquid, or gas - either on the land, in the water, or in the air. EPA is concerned particularly about the problem of the ultimate disposal of sewage sludge, which will be produced in ever increasing quantities as municipalities install more advanced forms of sewage treatment.

EPA, continuing the work of its predecessor agencies, has been developing environmentally acceptable methods for the disposal and management of municipal sludge since the enactment of the first Federal Water Pollution Control Laws. The study of alternatives to ocean dumping of municipal sludge

normally has not been funded through the ocean dumping program, but under the Federal Water Pollution Control Act since municipal sludge is an integral part of the sewage treatment process.

The initial phases of the research program were concerned with the characteristics and dewatering properties of primary and secondary sludge because of the need to dewater sludge before its ultimate disposal. The current research and demonstration program emphasis has shifted toward development of improved technology for returning sludge to the environment in an ecologically acceptable manner. In FY 76 nearly $3 million was allocated on such programs, including secondary health and ecological effects of the alternatives to ocean disposal. The emphasis of these projects was on beneficial utilization, i.e., land application for soil enhancement, crop production and reclamation of disturbed lands, the production of energy, and resource recovery.

EPA plans to continue its comprehensive program for municipal wastewater sludge management. This program will concentrate on demonstration of new technologies which will recycle or reuse sludges, or recover residuals contained in the sludges. For example, new technologies are being examined to determine if there are cost-effective methods for producing or recovering marketable products in the processing of sludge. These products include metals re-

covery, organic acids, fertilizer bases, soil conditioner, methane, and the recovery of process heat.

Health effects research will include investigations into land application, disinfection, and composting. The health effects of airborne contaminants from incinerators and the improved technology for reducing or eliminating pollution emissions will be evaluated. It is also EPA's intent to continue cooperative agreements with other Federal, State and local agencies.

In addition to research and demonstration programs, EPA is undertaking pilot studies for the design of new and innovative technologies for sludge as well as studies of regional solutions to sludge issues. Presently over $11 million has either been obligated or is in the process of being committed for such studies. This work is being done under the FWPCA.

One alternative showing particular promise is the composting of sludge with various bulking agents such as wood chips, bark or solid waste. EPA has a joint project with the Department of Agriculture in Beltsville, Maryland and is conducting a composting demonstration program in Bangor, Maine. Composting stabilizes the sludge and if designed properly can kill pathogens in the process. The land area required for composting as a means of stabilizing sludges is small and in some cases an energy saving can be realized by using this method. The product resulting from composting has been shown to be an excellent soil conditioner.

Another alternative being used by many cities is the direct application of liquid or dried sludge to farm land or forests. EPA estimates that about 25% of the municipal sludges are currently being disposed of in this manner. This method has been frequently used to provide all or part of the fertilizer requirements for growing forage crops and grain. Such direct applications of sludge have also been used to reclaim strip mined or otherwise disturbed lands (shifting sand dunes, mine spoils, etc.). EPA has initiated studies to survey the results of such city programs to document more adequately current nationwide practices in land application of sludges.

Composting and direct application of sludges are examples of alternative methods of sludge management where the nutrient value of the sludge is being used. One firm is working with adding nitrogen to the sludge so that it becomes a high grade fertilizer. Another option for this beneficial use of sludges that has been an accepted practice in several areas of the country for many years is the commercial operator who simply bags dried sludge and sells it as a soil conditioner. However, any disposal/management alternative which results in sludge being applied to the land creates the potential for pollutants, particularly trace metals and nitrates, to leach into ground water or enter the food chain. To date, no link to adverse health effects from land application has been demonstrated by EPA's research efforts, but work is continuing in this area.

In urban areas where the scarcity of open land inhibits the employment of any alternatives using land application, pyrolysis may be the answer. Pyrolysis is the thermal decomposition of materials into gases, liquids, and char in the absence or near absence of oxygen. The gases and liquids can be used as a fuel and the char is amenable to landfill disposal. A pilot study at Orange County, California, is being designed to convert the sludge pyrolysis char into activated carbon. The carbon will then be recycled to treat the sewage. In this way it may be possible to upgrade the conventional activated sludge system to achieve a substantial reduction in the quantity of sludge. Such a system can also produce its own power needs as well as some excess power. In another program, a pilot pyrolysis plant converting solid waste has been built by EPA in conjunction with the City of Baltimore, Maryland. At present, the operation of the plant is awaiting the correction of technological problems encountered during the plant's trial run. Another pyrolysis system using solid waste, sludge and coal is being developed in South Charleston, West Virginia with the aid of an EPA grant. Finally, EPA Region II has provided a grant of $169,000 to the Interstate Sanitation Commission for the conversion of an existing sludge incinerator into a pilot pyrolysis plant for sewage sludge. Once constructed, it is expected that the plant should significantly reduce air pollution problems, and the residue should be of better quality for landfill disposal. However, until pyrolysis is perfected, traditional sludge incineration may be the best sludge disposal alternative for those urban areas without air pollution problems.

At present, the elimination of ocean dumping is a laudable goal. The pursuit of alternative methods of waste disposal must be continued. However, there are many remaining unanswered questions regarding the overall problem of the pollution of the marine environment, what is known about it, and what are the impacts of alternative methods of disposal. There may be circumstances where ocean dumping of certain wastes may cause no harm to the ocean or may be the most overall environmentally acceptable solution. Thus, while EPA is continuing to scrutinize carefully all applications for ocean disposal permits to insure that harmful dumping is eliminated as rapidly as possible, it is investigating the broader issue of sludge utilization or disposal to develop the most environmentally accepted waste management program.

The general problem of pollution of the marine environment has numerous components, of which pollution by ocean dumping is only one. Other significant sources of pollution are ocean outfalls, discharges from offshore platforms, and land runoff from rivers and estuaries. Most forms of pollution from these sources are regulated under the FWPCA Amendments of 1972 through the National Pollutant Discharge Elimination System, and specifically Section 403(c) which requires the setting of ocean discharge criteria for ocean outfalls. EPA applies the same strict criteria to outfall disposal as it does to ocean dumping, in addition to requiring at least secondary treatment for all municipal sewage.

In looking to the future, it can be expected that increases in population and industrial growth in coastal areas, which historically tend to grow more rapidly than inland areas, will result in greater pressures for ocean disposal either by outfall or by dumping, in addition to much larger quantities of effluents being discharged in rivers and estuaries. All these sources of pollution of the marine environment must be regulated and strictly controlled to limit adverse impacts and to insure that the best environmental alternatives are chosen.

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